

# Quality Indicators Sensitive to Nurse Staffing in Acute Care Settings

Lucy A. Savitz, Cheryl B. Jones, Shulamit Bernard

## Abstract

**Objective:** In this era of patient safety, quality indicators associated with the nursing profession have evolved from nursing-sensitive to adverse event-sensitive. This paper aims to compare and contrast available quality indicator tools associated with nurse staffing outcomes. **Methods:** We conducted a systematic review of literature from the past 6 years, identifying research and/or monitoring efforts reporting structure, process, and/or outcomes measures associated with nursing care. Twenty-four articles were selected, and identified indicators from the National Quality Forum were compared/contrasted with relevant AHRQ Patient Safety Indicators. **Results:** The results of this study provide an important comparative assessment of the types, content, and intended purpose of available nursing indicators. We found little overlap and direction in the types of indicators available to examine the influence of nurse staffing on the outcomes of care. Further, there are no process measures available. The need for consistent indicator definitions and process measures is addressed. **Conclusions:** The central role nurses play in patient safety suggests a need for consensus on a set of measures that will enable us to examine the impact of staffing changes on the quality of care received. To support institutionalization of this set, research examining the sensitivity of available, evidence-based indicators (outcomes) sensitive to nurse staffing is needed. Such indicators could be used to evaluate the outcomes of nursing practice when changes are made in care processes or the delivery of nursing care.

## Introduction

Recent reports from the Institute of Medicine's Quality Initiative brought public attention to the urgent need for understanding, measuring, improving, and ensuring the quality of health care in the United States. These reports focused on important aspects of health care quality, such as revealing serious health care systems errors and patient safety concerns,<sup>1</sup> recommending a taxonomy of quality attributes for the health care system,<sup>2</sup> proposing quality enhancement initiatives to coordinate quality-related efforts in six government programs,<sup>3</sup> offering recommendations for interdisciplinary education in the health professions,<sup>4</sup> and identifying changes needed in the work environment for nurses to improve patient safety.<sup>5</sup> The reports of this initiative represent a systematic effort to focus on quality and patient safety concerns in health care and to advance critical health care quality initiatives in the United States.

Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>2005</b>		2. REPORT TYPE <b>N/A</b>		3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>Quality Indicators Sensitive to Nurse Staffing in Acute Care Settings</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Agency for Healthcare Research and Quality 540 Gaither Road, Suite 2000 Rockville, MD 20850</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>Published in Advances in Patient Safety: From Research to Implementation. Volumes 1-4, AHRQ Publication Nos. 050021 (1-4). February 2005. Agency for Healthcare Research and Quality, Rockville, MD. <a href="http://www.ahrq.gov/qual/advances/">http://www.ahrq.gov/qual/advances/</a>.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>UU</b>	18. NUMBER OF PAGES <b>12</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

Though putting recommendations from these reports into practice is challenging, macro-level quality initiatives are ongoing in the public and private sectors. For example, within the Federal Government, the Quality Interagency Coordination Task Force (QuIC) was created, bringing together independent initiatives within various governmental entities that relate to or impact health care quality. Additionally, the National Healthcare Quality Report,<sup>6</sup> developed by the Agency for Healthcare Research and Quality (AHRQ), presents data on the quality of services for seven clinical conditions and includes a set of performance measures that can serve as a baseline for the quality of health care.

In recent years, private groups, such as the Leapfrog Group, the National Quality Forum (NQF), and the Joint Commission on Accreditation of Health Care Organizations (JCAHO) initiated efforts and made recommendations for improving and ensuring health care quality. Many of these efforts represent an attempt to move closer to the point of care delivery. In addition, professional organizations and provider groups, such as the American Nurses Association (ANA), the American Medical Association (AMA), and the Veterans Health Administration (VHA) also have initiated quality surveillance activities aimed at identifying and capturing provider- and profession-specific clinical quality indicators. Finally, public reporting of health care quality data is believed to drive quality improvement, expanding the role and potential value of quality indicators.<sup>7</sup>

Research is addressing the effect of professionals and various aspects of care delivery on quality and patient safety in America. For example, recent studies documenting the relationship between nurse staffing levels in hospitals and nursing-sensitive patient outcomes received a great deal of attention in the press.<sup>8–10</sup> These studies were conducted at a time when restructuring and downsizing were occurring in U.S. hospitals, and also when nurses reported staffing shortages, concerns about compromised quality of care, job dissatisfaction, and burnout.<sup>11</sup> The findings of these studies provide a beginning basis for establishing clinical practice, health care systems, and public policy decisions aimed at providing adequate nursing care to meet patient needs in hospitals.

Maas, Johnson, and Morehead<sup>12</sup> coined the phrase “nursing-sensitive indicators” to reflect patient outcomes that are affected by nursing practice. Needleman et al.<sup>13</sup> point out, however, that while “nursing-sensitive indicators” is a comprehensive term, most of the research in this area focuses on the relationship of nursing with negative—or adverse—patient outcomes, such as medication errors, patient falls, and nosocomial infections. In fact, they note that far fewer studies examine the relationship of nursing and positive patient outcomes. They attribute the predominant use of negative outcomes to the fact that adverse patient outcomes are more readily available in medical records and existing administrative data sets. Needleman et al. use the phrase “outcomes potentially sensitive to nursing” to recognize nursing contributions in the clinical care delivery process; however, the tentativeness of the term points out the difficulty in determining attribution when care delivery processes are intertwined.

Measures of quality in health care are generally accepted as those indicators representing structure, process, and/or outcomes.<sup>2, 14</sup> It is unclear, however, whether there is consistency in how quality is defined and measured across indicator tools as well as within and among professional and provider groups. Several attempts have been made to more clearly delineate and define indicators of quality and, more recently, indicators of patient safety. The most comprehensive of these is a package of quality indicators developed by the AHRQ. These indicators, known as the AHRQ Quality Indicators, represent an evolution of AHRQ's interest in quality of care and consist of three indicator sets: prevention quality indicators, inpatient quality indicators, and the patient safety indicators (PSIs).

In general, there are three primary ways that these types of indicators can be used to assess outcomes sensitive to nursing care:

- Indicators can be used for quality improvement purposes in applied settings to monitor performance and progress and to support evidence-based decisionmaking.
- Indicators can be used to support informed policy analysis related to regulatory or accreditation requirements, workforce development, and reimbursement.
- Indicators can be used to research the role of nursing care in determining patient safety outcomes by examining structure-outcome, process-outcome, and structure-process-outcome relationships.

While all of these are important, the focus of this paper is on how such measures can be used for quality improvement purposes in exploring available indicators sensitive to nurse staffing in acute care settings.

Very little is known about how profession-specific quality indicators can be used to monitor safe practices and to drive improvements aimed at eliminating or mitigating adverse events. A comprehensive assessment of outcomes sensitive to the care of nursing in acute care settings is important from a patient safety perspective because (1) nurses represent the largest component of the health care workforce, and (2) nurses play an important role in detecting and/or mitigating adverse events. A primary area of nursing responsibility is the ongoing surveillance of patients such that "...ongoing patient assessment and evaluation are the two guideposts of licensed nursing care between which hands-on nursing treatments, patient education, and care planning are delivered."<sup>5</sup> Further, lead policy agencies and organizations recently released patient safety indicators, but there has been no structured comparison of the relative contribution of the AHRQ PSIs, NQF's nursing performance indicators, and ANA's nursing-sensitive quality indicators that advances our ability to monitor trends and patterns among identified adverse events sensitive to nursing practice.

The purpose of this paper is threefold: (1) to review the literature on indicators sensitive to nurse staffing; (2) to compare and contrast available AHRQ PSIs, NQF, and ANA indicators for assessing the outcomes of nurse staffing to

ascertain if a core set of indicators emerges; and (3) to suggest next steps to advance nursing performance measurement. We also identify research gaps related to nurse staffing and patient safety to focus future research. It is anticipated that the results of our analysis could be used as a foundation to inform policy development, research, and quality monitoring and improvement efforts in acute care hospitals.

## **Methods**

We conducted a meta-synthesis<sup>15</sup> of published reports that described indicators or measures that could be used to assess the outcomes of nurse staffing. This approach allowed us to inductively ascertain the current state of measures available to assess the outcomes of nurse staffing.

To be included in our analysis, a published report had to provide measures associated with the structure, process, and/or outcomes of nursing care in inpatient, hospital settings with sufficient detail on indicator purpose and construction. Further, the searches were limited to English, human studies published from 1997 through March 2004. We limited our search in an effort to build on the thorough review conducted by Pierce that covered 1974–96.<sup>16</sup>

We used a three-stage search process to identify reports that included (1) a systematic search of MEDLINE® via the PubMed database, (2) a targeted search of select Web sites, and (3) subsequent review of relevant articles referenced in abstracted items from the initial two sources and/or professional contacts among the author group. Our targeted Web-site search focused on the AHRQ, JCAHO, NQF, and the ANA indicators based on our knowledge of recent work in this area.

We developed a systematic data abstraction sheet, which was maintained in Microsoft® Excel. Key attributes developed for relevant articles were:

- Data source and indicator definition, including numerator and denominator specification.
- Unit of analysis.
- Risk adjustment, if any.
- Evidence for the indicator as a measure of safe nursing care.
- Available validation information.
- Purpose for which the indicators were developed.

Reports of indicators were further classified into these categories for analysis purposes. From this process, we report the results of our analysis.

## **Results**

The results of this study provide an important comparative assessment of the types of available nurse staffing indicators sensitive to patient outcomes. In recent

years, a number of researchers and national organizations developed and released a set of quality indicators, some of which were shown to be sensitive to nurse staffing. In this paper, we catalogue and compare recently released indicator sets from AHRQ, NQF, and ANA, with an eye toward developing a core set of indicators that can be used in a variety of settings and that can motivate meaningful comparisons across diverse sites and over time.

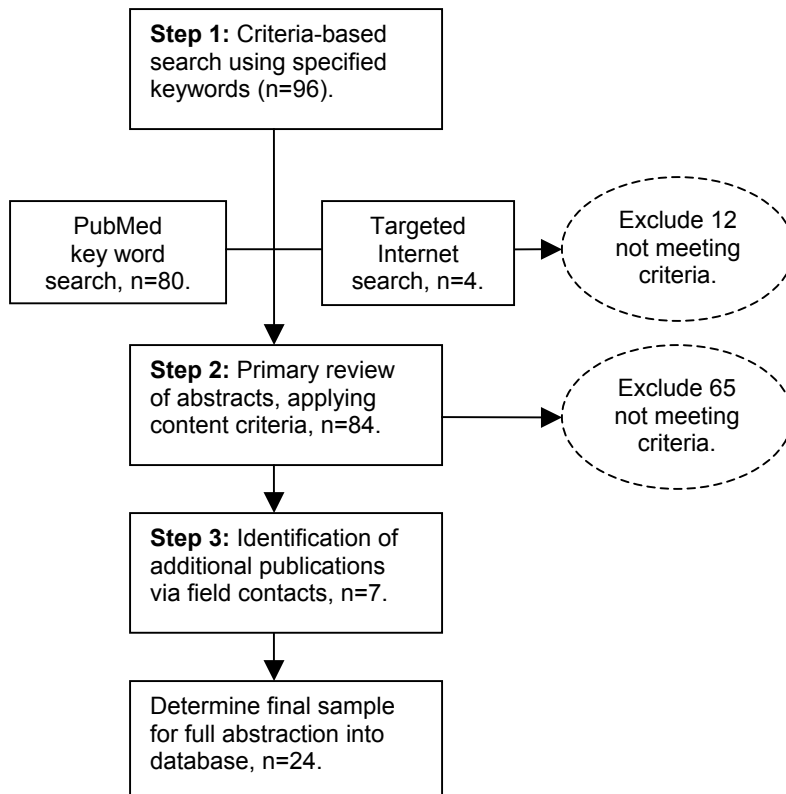
The results of our literature search are provided in Figure 1. MEDLINE search terms with search results noted in parentheses, included:

- Nurse sensitive AND indicators (n=30).
- Indicators AND American Nursing Association (n=39).
- Nurse staffing AND adverse events OR medical errors (n=11).

The search term “nursing AND outcomes” was abandoned because it was too broad, with more than 4,500 matches. Accounting for overlap across search terms, we identified 24 articles for review (a full listing of abstracted articles is available from the corresponding author).

Looking across the body of literature included in our assessment, we find an emphasis on the structure of care (54 percent of papers), with primary focus on measures that are intended to reflect the mix and intensity of nursing practice. The majority of studies look at nurse staff mix, proportion of RNs with a baccalaureate

**Figure 1. Literature search results**



degree, patient-to-nurse ratios, and/or hours of nursing care. As Mark, Hughes, and Jones<sup>17</sup> suggest, these different measures of nurse staffing represent different conceptual approaches, which make it difficult, if not impossible, to draw conclusions.

Process measures under the scope of nursing practice were almost never reported. When thinking about the process of nursing care, the following types of measures could be considered:<sup>18–20</sup>

- Unfinished or incomplete care.
- Use of standard technique (e.g., hand washing, skin preparation, wound dressing).
- Prudent monitoring of invasive medical devices (e.g., catheters, chest tubes, IVs).
- Systematic skin inspection, cleaning, and positioning.
- Adherence to care pathways/protocols.

Other types of measures that reflect communications, collaboration, documentation, and teamwork may be important as well. These types of measures are not found in administrative databases, which is the likely reason they were not identified through our search. Data systems that use standard definitions would need to be developed to consistently capture these.

Only one study<sup>20</sup> was found that included process measures. Standardized data availability poses the largest limitation in using process measures. Process measures are not available for comparative analysis since nursing assessments are loaded into global fees and not reported in consistent, secondary data such as ICD codes on billing records. For this reason, process measures are not included in large administrative data sets, which are used in many of the staffing studies that rely on secondary data analyses.

In assessing the literature relevant to nursing care and patient outcomes (50 percent of papers), we observed that these reports almost exclusively focused on negative outcomes or adverse events. Only one identified study examined the influence of nursing practice on positive patient outcomes.<sup>21</sup> We also found that the ANA's initial work on nursing practice and adverse events was extended to move beyond a limited set of overarching indicators related to medication administration errors, nosocomial infections, patient falls, pressure ulcers, and mortality, with increasing detail in measure specification.<sup>11</sup> For example, nosocomial infections are broken down into urinary tract infections, surgical wound infections, blood stream infections or sepsis, and pneumonia. This is depicted in Table 1, which compares AHRQ PSI, ANA, and NQF measures. These measures ostensibly reflect the unique contributions of nursing practice to patient safety.

**Table 1. Comparison of relevant AHRQ, ANA, and NQF patient safety measures**

	<b>AHRQ PSI (select accepted n=7)</b>	<b>Provisional NQF (n=13)</b>	<b>ANA (n=10)</b>
Death in low mortality DRG	X		
<b>Decubitus/pressure ulcer</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Failure to rescue</b>	<b>X</b>	<b>X</b>	<b>X</b>
Infection due to medical care	X		
• Urinary tract infection (UTI) prevalence		X	X
• Central line catheter associated blood stream infection		X	
• Urinary catheter associated UTI for ICU patients		X	
• Surgical wound infection			
• Septicemia/blood stream infection	X		
• Hospital acquired pneumonia	X	X	
• Ventilator associated pneumonia		X	
Patient falls		X	X
Restraint prevalence		X	
Smoking cessation counseling		X	
Postoperative PE or DVT	X		
Nurse staff satisfaction			X
Patient satisfaction with specific elements of care			X
Nurse staffing skill mix		X	X
Total nursing care hours provided per patient day		X	X
Practice environment scale—Nursing Work Index		X	

**Note:** Definitions may vary while naming conventions may be the same. Only two indicators, presented in boldface type, are common to all three sets of indicators.

We used our literature search to guide the selection of relevant PSI indicators and then compared them with those from ANA and NQF, which are the two leading alternative indicator sets. We see virtually no direct overlap in these measure sets, with the exception of decubitus/pressure ulcer and failure to rescue. Caution should be taken since the measure intent is similar but definitions of these indicators vary. Despite the limited concordance, the predominant comparative differential comes from the process by which these indicators were identified with the AHRQ PSIs being derived from a combined evidence-based, expert panel approach.<sup>22–24</sup> This may be one reason that certain expected outcomes appear on



one list (e.g., urinary tract infections on NQF) and not on another (e.g., urinary track infection on AHRQ PSIs).

In addition to variations in indicator definition across reported studies and lack of a core set of measures emerging from our comparative analysis, two issues were noted in examining measure standardization: indicator unit of analysis and risk adjustment. We found variation in unit of analysis across studies in the abstracted literature. While the clinical unit-level is preferred in general, much of the administrative data limits large-scale investigations to hospital-level data or makes it impossible to correct for inpatient versus outpatient care setting or administrative versus patient care nurse staffing. In only one case, nurse-specific assessments were done, based on patient workload by shift.<sup>8</sup> Increasingly, sophisticated information technology systems will allow efforts to drill down and examine structure, process, and outcome measures by shift in root cause analyses and identification of targeted quality improvement interventions.

We observed a variety of risk adjustment approaches that were reported in the reviewed literature. Selected methods were largely dependent on data availability and purpose of the research effort. These included case mix index, stratification by specialty unit classification or other structural measures,<sup>25</sup> nursing intensity weights,<sup>21</sup> and probability of an adverse event.<sup>26</sup>

## **Discussion**

The results of our review do not point to specific indicators that should necessarily be examined in monitoring performance and examining trends in safety as they related to nurse staffing. However, our review of the literature did identify three important lessons. First, we learned it is important to take a comprehensive view of nurse staffing and quality indicators, and not to look at a single indicator in isolation.<sup>27</sup> Secondly, we learned from our AHRQ-funded research, whereby we worked with hospitals and states using these kinds of indicators, that such measures offer a retrospective surveillance tool at a macroscopic level. Thus, outlier indicator values do not necessarily indicate a problem, but rather identify a need to drill down and learn more about what is or is not happening to result in an unexpected high or low value. In reviewing work by Shortell<sup>28</sup> and Mattke et al.<sup>29</sup> that suggests an important organizational structure perspective, we would expect to find a broader mix of organizational factors appearing across all the reviewed studies. We found gaps in this area, namely that organizational factors and information technology are important aspects of care delivery that must be examined to gain a more comprehensive understanding of their influences on safe nursing care practices.

Despite the IOM reports calling for the creation of a standardized set of measures for monitoring the quality and effect of structural changes on the process and outcomes of nursing care, we did not observe a unified direction emerging in the literature. Our review suggests that the following problems persist in our efforts to examine profession-specific quality of care:

- Lack of standardized performance measure definitions.
- Lack of consensus on a core set of evidence-based measures.
- Limited availability of data at the unit and/or shift level.

As such, controversy regarding the appropriate definition, number, and approach to indicator identification was found to persist.

## Recommendations

Nurses play a central role in direct patient care and safety surveillance at the point of care.<sup>5</sup> This role suggests a need for consensus on a core set of measures that can be used to monitor safe practices and guide resource allocation decisions that affect patient outcomes in our fiscally constrained health care system. Arriving at such consensus was beyond the scope of this review. However, the lack of agreement among indicators, their measurement, and their use leads us to recommend that a systematic, evidence-based review of nurse staffing and quality indicators be conducted to help us achieve such consensus. We hope this consensus process will facilitate the determination of nurse staffing measures that are more conceptually appropriate than the available measures used in research to date.<sup>17</sup>

To support the adoption and institutionalization of a patient safety indicator set, the field is in need of research that examines the sensitivity of available, evidence-based indicators (outcomes) that are affected by nurse staffing.<sup>10</sup> Moreover, we strongly recommend a move beyond the examination of nurse staffing per se to an examination of indicators sensitive to other aspects of nursing care and the practice of nursing. Specifically, we recommend that research is needed to:

- Explore other structural measures of nursing care beyond simply nurse staffing.
- Examine broader aspects of the processes of nursing care, and especially those related to patient safety, such as unfinished care,<sup>20</sup> standardization of care,<sup>2</sup> monitoring of invasive devices, teamwork and communication, and models of care delivery.
- Define more comprehensive data needs beyond those data typically included in administrative data sets.<sup>13</sup>
- Examine the influence of nursing care and practice on positive patient outcomes.<sup>25</sup>
- Focus on the patient care unit or episode of care as the unit of analysis.
- Incorporate appropriate risk-adjustment approaches.

Such research is needed to help us gain a better understanding of structure-outcome, process-outcome, and structure-process-outcome relationships relevant to nursing care and practice. It also is needed to aid in the monitoring of nursing

practice outcomes when changes in care process and changes in accepted nursing practice are made. As in any such effort, selected quality indicators need to be based on the purpose of study and the intended target audience. A comprehensive set of indicators that supports the management of patient and nursing care delivery versus the allocation of nurses alone would provide the necessary perspective needed to drive safe practices and quality improvements.

## Acknowledgments

AHRQ IDS Research Network Contract 290-00-0018, Task 3.

We would like to thank Ms. Cynthia Palmer for her support and encouragement through the Integrated Delivery System Research Network.

## Author affiliations

RTI International (LAS, SB). University of North Carolina School of Nursing (CBJ).

*Address correspondence to:* Dr. Lucy Savitz, RTI International, Health Care Quality & Outcomes Program, 3040 Cornwallis Road, Research Triangle Park, NC 27709; phone: 919-316-3301; e-mail: Savitz@rti.org.

## References

1. Kohn LT, Corrigan JM, Donaldson MS, editors. To err is human: building a safer health system. A report of the Committee on Quality of Health Care in America. Institute of Medicine. Washington, DC: National Academy Press; 2000.
2. Crossing the quality chasm: a new health system for the 21st century. Institute of Medicine. Washington, DC: National Academy Press; 2001.
3. Corrigan J M, Eden J, Smith BM. Leadership by example: coordinating government roles in improving health care quality. A report of the Committee on Enhancing Federal Healthcare Quality Programs. Institute of Medicine. Washington, DC: National Academy Press; 2002.
4. Greiner AC, Knebel E. Health professions education: a bridge to quality. A report of the Committee on the Health Professions Education Summit. Institute of Medicine. Washington, DC: National Academy Press; 2003.
5. Page A. Keeping patients safe: transforming the work environment of nurses. A report of the Committee on the Work Environment for Nurses and Patient Safety Board on Health Care Services. Institute of Medicine. Washington, DC: National Academy Press; 2004.
6. National healthcare quality report. Agency for Healthcare Research and Quality. Department of Health and Human Services. Washington, DC: National Academy Press; 2003. (Prepublication copy.)
7. Hibbard JH, Stockard J, Tusler M. Does publicizing hospital performance stimulate quality improvement efforts? *Health Aff* 2003;22(2):84–94.
8. Aiken LH, Clarke SP, Sloane DM, et al. Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *JAMA* 2002 Oct 23–30;288 (16):1987–93.
9. Kovner C, Jones C, Zhan C, et al. Nurse staffing and post-surgical adverse events: an analysis of administrative data from a sample of U.S. hospitals, 1990–96. *Health Serv Res* 2002;37(3):611–30.
10. Needleman J, Buerhaus P, Mattke S, et al. Nurse-staffing levels and the quality of care in hospitals. *NEJM* 2002;346(22):1715–22.
11. American Nurses Association. Health and safety survey 2001. <http://nursingworld.org/surveys/hssurvey.pdf>. (Accessed 2003 Sep 11.)
12. Maas M., Johnson M, Moorehead S. Classifying nursing-sensitive patient outcomes. *J Nurs Scholarsh* 1996;28(4):295–301.
13. Needleman J, Buerhaus PI, Mattke S, et al. Nurse staffing and patient outcomes in hospitals. Final report for Health Resources and Services Administration contract # 230-99-0021. 2001. <ftp://ftp.hrsa.gov/bhpr/nursing/staffstudy/part1.pdf>. (Accessed 2004 Apr 23.)

14. Donabedian A. Explorations in quality assessment and monitoring. Vol 1. Ann Arbor, MI: Health Administration Press; 1980.
15. Paterson BL, Thorne SE, Canam C, et al. Meta-study of qualitative health research: a practical guide to meta-analysis and meta-synthesis. Thousand Oaks, CA: Sage Publications; 2001.
16. Pierce SF. Nurse-sensitive health care outcomes in acute care settings: an integrative analysis of the literature. *J Nurs Care Qual* 1997;11(4):60–73.
17. Mark BA, Hughes LC, Jones CB. The role of theory in improving patient safety and quality health care. *Nurs Outlook* 2004;52(1):11–6.
18. White P, Hall LM. Patient safety outcomes, In: Doran DM, editor. *Nursing sensitive outcomes: state of the science*. Sudbury, MA: Jones & Bartlett; 2003.
19. Mark BA, Burleson DL. Measurement of patient outcomes: data availability and consistency across hospitals. *J Nurs Adm* 1995;25(4):52–9.
20. Sochalski J. Is more better? The relationship between nurse staffing and the quality of nursing care in hospitals. *Med Care* 2004 Feb;42(2 Suppl 2):67–73.
21. Lichtig LK, Knauf RA, Milholland DK. Some impacts of nursing on acute care hospital outcomes. *J Nurs Admin* 1999;29(2):25–33.
22. McDonald K, Romano P, Geppert J, et al. Measures of patient safety based on hospital administrative data—the patient safety indicators. AHRQ Publication No. 02-0038. Rockville, MD: Health and Human Resources; 2002.
23. American Nursing Association. Nursing-sensitive quality indicators for acute care settings and ANA’s safety and quality initiative. 2002
24. National Quality Forum. National voluntary consensus standards for hospital care: an initial performance measure set and draft national voluntary consensus standards for nursing sensitive performance measurement. 2004
25. Whitman, GR, Kim Y, Davidson LJ, et al. Measuring nurse-sensitive patient outcomes across specialty units. *Outcomes Manage* 2002 Oct–Dec;6(4):152–8; quiz 159–60.
26. Cho SH, Ketefian S, Barkauskas VH, et al. The effects of nurse staffing on adverse events, morbidity, mortality, and medical costs. *Nurs Res* 2003 Mar–Apr; 52(2):71–9.
27. Curtin LL. Nursing productivity: from data to definition. *Nurs Manage* 1995 Apr;26(4):25, 28–9, 32–6.
28. Shortell SM, Zimmerman JE, Rousseau DM, et al. The performance of intensive care units: does good management make a difference? *Med Care* 1994 May;32(5):508–25.
29. Mattke S, Needleman J, Buerhaus P, et al. Evaluating the role of patient sample definitions for quality indicators sensitive to nurse staffing patterns. *Med Care* 2004 Feb;42(2 Suppl 2):21–33.

